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THE JOURNAL OF ENTOMOLOGY AND ZOOLOGY

William A. Hilton, Editor

Claremont, California, U. S. A.

A New Eriococcus

E. O. ESSIG

SECRETARY STATE COMMISSION OF HORTICULTURE,
SACRAMENTO, CALIFORNIA

Eriococcus cockerelli n. sp.

Description—The adult females are enclosed in a thin, felt-like, nearly globular sac varying in color from pure white to pinkish and averaging three-sixteenths of an inch in diameter

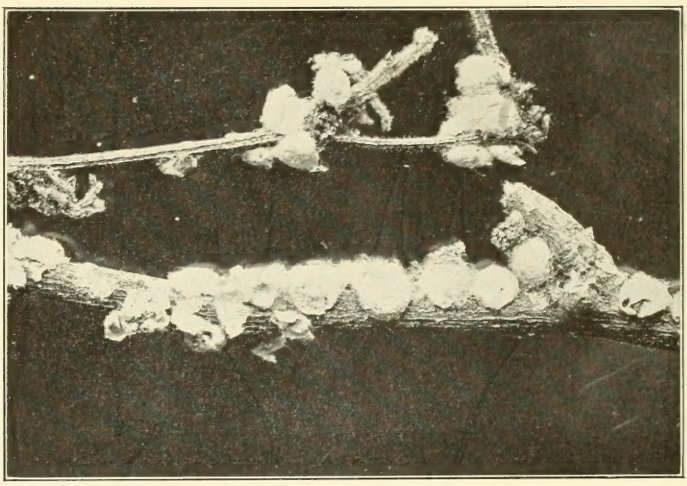

Figure 1. *Eriococcus cockerelli* n. sp. Adult females *in situ* on twig. Twice enlarged. (Original).

(Fig. 1). The body is oval in shape being slightly longer than broad and distinctly convex on the upper surface. The color of the dried specimens received is deep purplish red, turning cardinal when first boiled in K O H but subsequently becoming colorless and perfectly transparent excepting the spines, legs, mouth-parts and antennæ which remain light brown or amber. The body is thickly covered with stout spines, there being three common sizes (Fig. 2, B) of the following lengths: 0.05 mm., 0.037 mm. and 0.028 mm. The length of the type specimen is

2.5 mm., width 1.9 mm. Many other adult female bodies were measured and the largest was 3.2 mm. long and 2.4 mm. wide, while the smallest was scarcely half as large. Antennæ (Fig. 2,

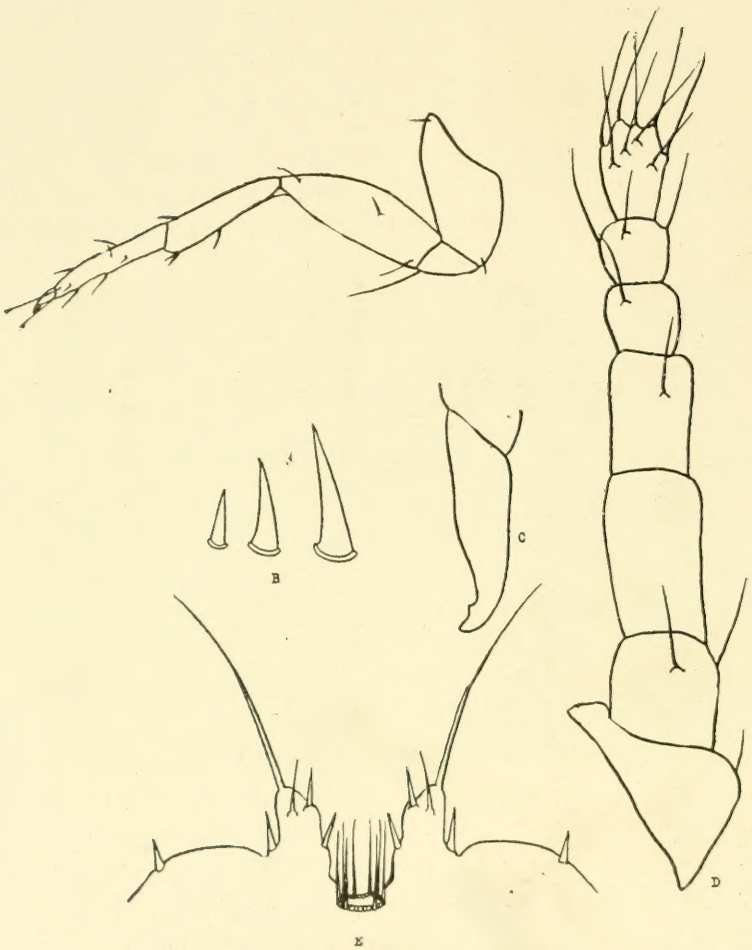

Figure 2. *Eriococcus cockerelli* n. sp. Left metathoracic leg. B, three common sizes of body spines; claw showing denticle; D, antenna; E, pygidium. All enlarged. (Original).

D) seven jointed, not very hairy and length of joints variable. The formula and measurements of the type specimen are as follows: III, 0.05 mm.; IV, 0.04 mm.; VII, 0.031 mm.; II, 0.03

mm., I, 0.025 mm.; V, 0.025 mm.; VI, 0.024 mm.; making the total length 0.225 mm. The following variations have been noted:

III, (IV, II, VII), I, (V, VI)
III, VII, (IV, II), I, VI, V
III, IV, II, (I, VII), V, VI
III, (IV, VII, II) I, (V, VI)

Legs (Fig. 2, A) large with few stout spines. Femora always longer than the tibiæ. Comparative lengths of the tibiæ and tarsi variable. Without considering the claw, either may be longer or they may be coequal. With the claw, the tarsus is always longer. The claw (Fig. 2, C) is only slightly curved and has a very small but distinct denticle on the inside near the tip. Digitals are long with large knob. Anal lobes (Fig. 2, E) distinct with long spine and four short stout spines on each. The eight circumanal spines are less than half as long as the long spines on the anal lobes.

Habitat—Nacon Chico, Sonora, Mexico.

Host—Reported on "Chino". As this is the Spanish word for quinine the plant probably belongs to the genus *Cinchona.*

Collector—Taken by Prof. C. H. T. Townsend May 1, 1911, and sent by him to Dr. T. D. A. Cockerell, who kindly forwarded the material to the writer. The species is named after Dr. Cockerell, who has on numberless occasions rendered valuable aid to the author's work on scale insects.

Studies in Laguna Beach Isopoda II B

BLANCHE E. STAFFORD, M. S.

Tylos punctatus Holmes and Gay

(Fig. 6)

Locality—Found in the sand at Laguna Beach; on being alarmed they rolled up in a compact ball.

Color—Gray, spotted with white.

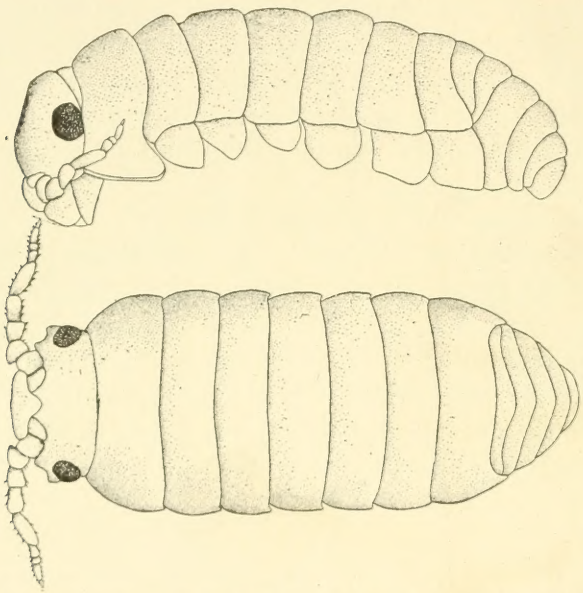

Figure 6. *Tylos punctatus* Holmes and Gay. Lateral and dorsal views.

Body oblong and very convex, manifesting very perfect ability to contract in the form of a ball. Covered with many minute spines. About twice as long as wide, 7 mm. by 3 mm. (measurements of a small specimen).

Head with lateral lobes produced into triangular projections in front of eyes. Eyes round and composite, situated postlaterally. First antennæ rudimentary, scale like. Second antennæ has peduncle of five articles: first three broad; first and

second subequal in length; second slightly shorter and has sharp projection on proximal inner angle. Fourth and fifth long and narrower; fifth, one and a third times longer than fourth. Flagellum composed of two short articles, a third equal to one and two, and a fourth short and conical. Antennæ profusely covered with spines. Extend scarcely to end of first thoracic segment.

Thoracic segments subequal: first slightly longer than those succeeding. Sutures of epimera distinct on all but first segment where epimera are indicated by a thickened margin. Epimera produced posteriorly and rounded. Legs ambulatory, all similar, very thickly spined. First leg has segments broader than those of following legs; first segment has a triangular process on exterior distal margin.

Abdomen composed of six segments. First two have lateral margins covered by seventh thoracic segment. Third broad, articulating with epimera of seventh thoracic segment on lateral margin, fourth rounded on lateral margin, slightly produced posteriorly as also the fifth which, however, is shorter and narrower. Sixth is truncate, short and broad. Uropoda have become opercular valves and have a short setose terminal joint.

Janira occidentalis Walker

(Fig. 7)

Locality—Large kelp holdfast from deep water, at Laguna Beach, Cal.

Color—White tinged with green and orange, finely spotted with brown; legs white.

Body about three times longer than wide, 6 mm. by 2 mm. Oblong, depressed along lateral margins. Slightly convexed on median line.

Head twice as wide as long, anterior margin not straight but produced into a slight median lobe; antero-lateral angles marked. Eyes large, round, composite and subdorsal in position. First antenna has first article of peduncle large, broad and long. Second and third subequal and much narrower than first. Fla-

gellum composed of twelve articles. Second antenna has first two articles subequal; third slightly larger, provided with antennal scale; fourth narrower and shorter than third; fifth and sixth long and narrow; sixth longer than fifth; flagellum multi-articulate. Maxillipeds with palp of five articles; first three subequal in width; fourth and fifth about half as wide. Mandible has a palp of three articles.

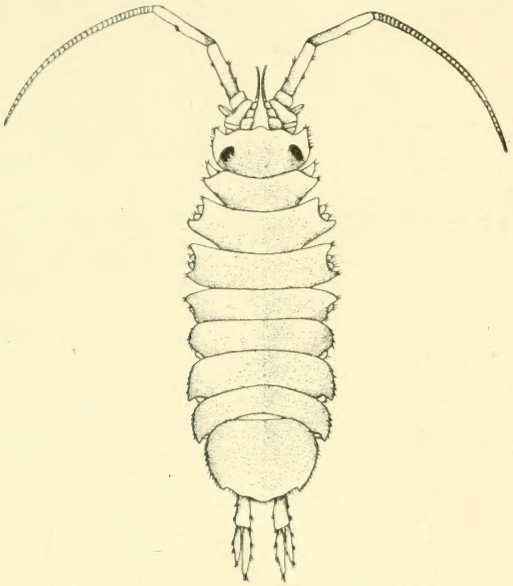

Figure 7. *Janira occidentalis* Walker.

Thoracic segments subequal in length. First segment of thorax has post-lateral angles rounded and prominent. Epimeral lobe occupies antero-lateral angles. Second and third segments have both antero- and post-lateral lobes with bilobate epimera between. Fourth segment has antero-lateral lobe prominent and rounded, post-lateral less prominent; single-lobed epimera between. Fifth similar to fourth with antero-lateral lobe much more rounded and conspicuous. Sixth and seventh have antero-lateral lobe very prominent and produced sharply at posterior extremity; post-lateral lobe obsolete, its place occupied by epimera. First pair of legs prehensile, remaining ambulatory

with bi-unguiculate dactyli. First leg has toothed propodus for half the proximal distance.

Abdomen composed of one large segment, possibly a very small anterior one though the suture was not distinct enough to make this certain. Telson is produced at post-lateral angles into a short, sharp point. Median part forms a rounded lobe. Uropoda composed of a peduncle about three times as long as inner ramus. Outer ramus slightly shorter than inner ramus.

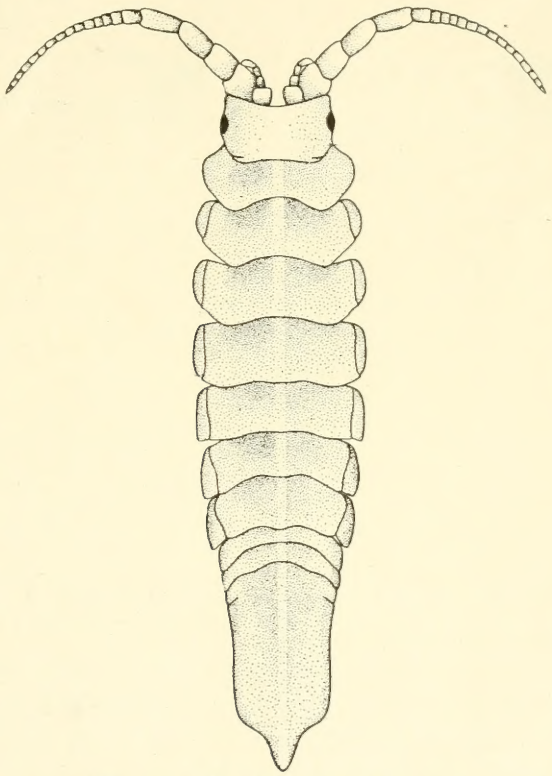

Figure 8. *Pentidotea aculeata* n. sp.

Pentidotea aculeata n. sp.

(Figs. 8, 9 and 10)

Locality—Low tide pools, Laguna Beach, California.

Color—Reddish brown in the male; female a more delicate pink with white spots along median line of back and two similar

rows of markings, each in a line half way between the median line and the lateral margin. Both male and female have all the segments and sutures outlined with a bright red line.

Body of male narrow and elongate and arched along median line. Length 23 mm., greatest width 6 mm., almost four times longer than wide.

Head about twice as wide as long, excavated on frontal margin with antero-lateral angles distinct but rounded. Posterior

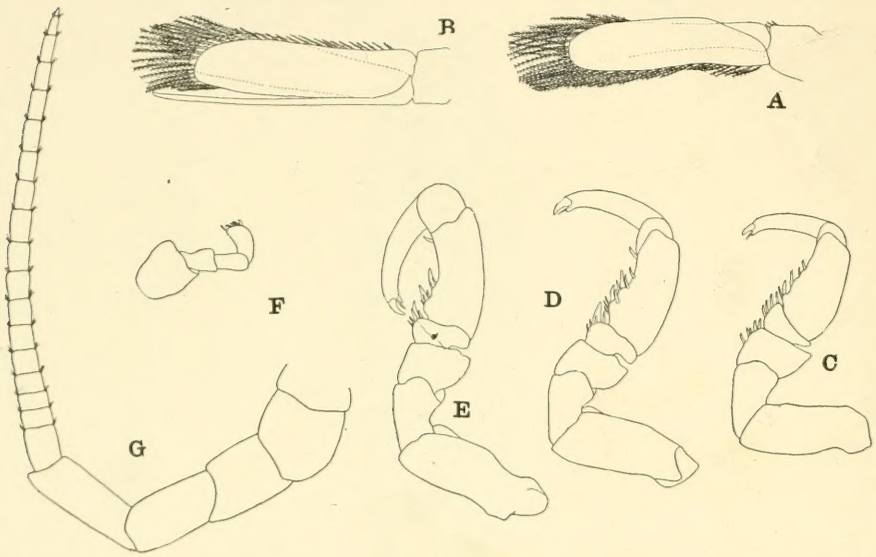

Figure 9. *Pentidotea aculeata* n. sp. A, first pleopod of male; B, second pleopod of male; C, first leg; D, second leg; E, seventh leg; F, first antenna; G, second antenna.

margin slightly concave with a short red mark extending horizontally from a post-lateral position. Eyes on lateral margin midway between anterior and posterior margins and almost round in shape. First antennæ possess four articles; first broad, almost as wide as long; following three articles not half as wide; second and third subequal; last clavate and slightly longer than the two preceding. First antennæ extend to end of second article of peduncle of second antennæ. Second antennæ have a peduncle of five articles: first short; second and third subequal, twice as

long as first; fourth not quite twice as long as third; fifth slightly longer than fourth; flagellum consists of seventeen or eighteen articles. Maxillipeds have a palp of five articles.

Sides of thorax almost parallel in male. All but first segment have epimera which extend to end of posterior margin. Epimera of second and third and fourth segments about equally wide from anterior to posterior margins. Fifth, sixth and seventh much narrower at anterior than at posterior margin. Legs alike in structure.

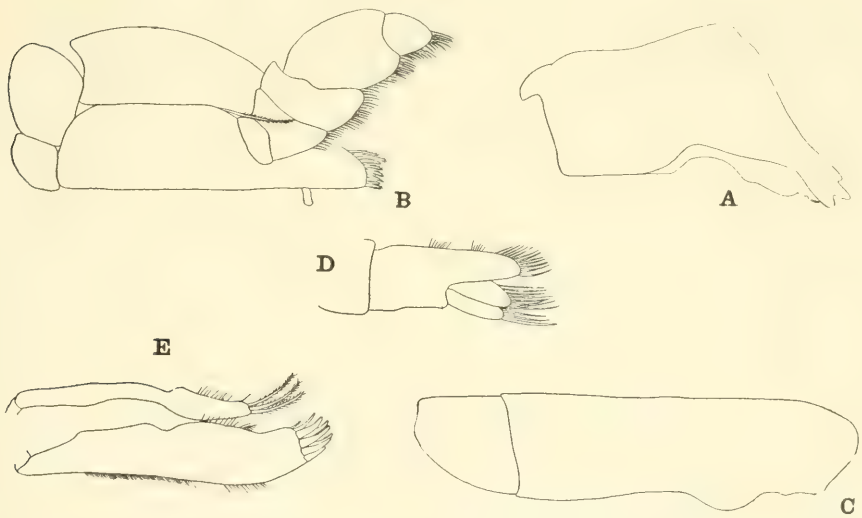

Figure 10. *Pentidotea aculeata* n. sp. A, mandible; B, maxilliped; C, opercular valve; D, second maxilla; E, first maxilla.

Abdomen 8 mm. long, 4 mm. wide at anterior end; composed of two short segments, a partially coalesced and a long terminal segment; the latter narrow and slightly excavate on the lateral margins, prolonged at median posterior extremity into a pronounced tooth, 1 mm. long. Post-lateral angles rounded. Opercular valves composed of a long anterior and a short posterior part. Carina not apparent on anterior portion.

The above description applies only to the male. Along with these a number of other specimens, all females, were collected which are slightly different in shape: have lateral margins less

parallel, more arched. They were lighter in color and more distinctly marked than the males. These differences are probably only sexual.

These specimens appear to lie close to *Pentidotea whitei* in many details, but in others are quite different. The male of *P. whitei* is described as being much larger—17 mm. by 34 mm.—and about three times as long as wide, whereas the male of these Laguna specimens is almost four times as long as wide. In *P. whitei* the epimeron of the second segment becomes narrower from the anterior to the posterior margin. Here the epimeral suture is practically vertical and the epimeron is about as wide anteriorly as posteriorly. The anterior margin of the head is more distinctly excavate and the antero-lateral angles more pronounced than in *P. whitei*. The eyes are about round, whereas in *P. whitei* they are twice as wide as long. The last abdominal segment is more elongate and the terminal process more pronounced than in *P. whitei*. It therefore seems evident that this isopod represents a new species.

The Nervous System of *Chelifer*

WILLIAM A. HILTON

There has been very little published on the nervous system and sense organs of arachnids and almost nothing on pseudoscorpions. There are, however, a large number of papers dealing with the classification of the latter and a few anatomical papers, such as those of Bertkau '87, Croneberg '88 and Supino '99. I have not seen these three works. There are no references given to them by the recent investigators of the arachnid nervous system.

Some of the early work dealing with the central nervous system of Arachnida we find recorded in the papers of Treviranus '16 and '32, Brandt '40, Grube '42. These authors describe and figure in a general way the external form of the nervous system of spiders. A more recent paper is that of Schimkewitch '84. This author considered the brain of Epeira and determined two regions in the supraesophageal ganglion, an optic region connected with the optic nerves, and a mandibular connected with nerves to the mandibles. Saint Remy '90 has an extensive contribution to the nervous system of spiders. He considers especially the brain in which he names the two chief regions, the ocular and the rostro-mandibular because the so-called mandibular nerve supplies the upper parts of the head as well as the cheliceræ. Many details of structure are given for the genera, *Lycosa, Thomisus, Epeira, Tegenaria, Drassus, Segestria, Pholcus* and *Eresus*. Something to correspond to mushroom bodies of insects is recognized in the posterior stratified body located in the uppermost part of the head in a lobe at the posterior dorsal region of the brain.

The paper of Lambert '09 is chiefly an embryological study of parts of the nervous system of *Epeira*. He figures the adult brain of *Argiope* with cheliceral and mandibular branches coming off from the subesophageal ganglion, or at least farther from the optic mass than they are usually described and figured. More recent papers on the nervous system of spiders are those

of Janeck '10, Hilton '12 and Haller '12. There is a more careful consideration of nerve tracts in the more recent papers. Haller recognizes anterior and posterior pedunculated bodies which may correspond with the striated body of Saint Remy.

One of the first papers dealing with scorpions was the one by Newport '43. In this the general form of the nervous system and its branches is considered. A little earlier than this, 1832, Treviranus gave a less perfect account of the nervous system of this form. Saint Remy '90 found a general agreement between the nervous systems of spiders and scorpions. Patten '90 published a paper including work on this group. In his book of 1912 there is also a considerable discussion of scorpions. The work of Haller '12 is an important one in this connection.

The literature on the nervous system of the other arachnid groups is very scanty. There is a paper of Borner '04 on the Pedipalpida. Allen '04 describes the nervous system of the cattle tick, as irregularly oval, pierced by the alimentary canal and penetrated by air tubes from opposite sides. The nerve trunks come off in pairs, five large and two small. Those who have studied phalangids are Treviranus '16, Tulk '43, Leydig '62, Saint Remy '90. Gaubert '93 describes ganglia in the feet of phalangids. Loman '05 describes the nervous system in phalangids. The usual nerves are described and a number of small lateral and intestinal ganglia are figured. The numerous papers on the nervous system of *Limulus* will not be mentioned at this time.

The species of *Chelifer* chiefly used in this investigation was *scabrisculus,* although a few specimens of *fuscipes* were examined. The small size of the animals and the strong chitin do not make this group a favorable one for the detailed examination of the nervous system. However, the group in itself is interesting and the more general features of the nervous system and sense organs will be considered as completely as possible.

The pseudoscorpions resemble scorpions in many external features, but seem to be closely related to spiders. The study of the nervous system seems to show a closer relationship with the spiders. In Vol. I, p. 621 of Parker and Haswell's zoology

there is a statement to the effect that there is some indication of an abdominal ganglion back of the cephalo-thoracic mass in pseudoscorpions. I have made series of *Chelifer* as well as a large number of dissections and have found no indication of such a ganglion in any of the specimens.

Methods. Due to the very resistant chitin it was very difficult to make good serial sections. Fluids which softened the chitin to any degree, ruined the internal organs at the same time. A few perfect series were obtained through the bodies of some of the younger specimens, but with the older ones it was necessary to remove a large part of the chitin of the body-wall, or to remove the nervous system entirely.

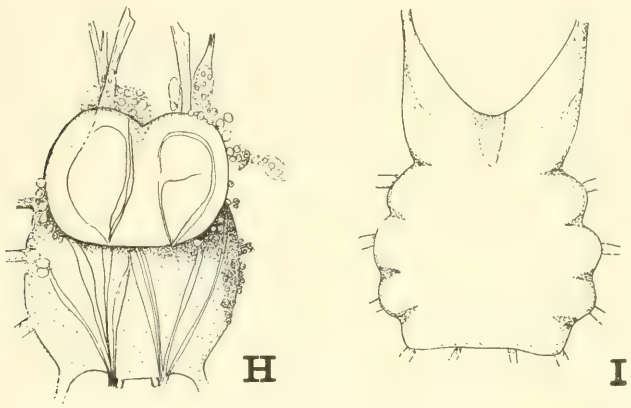

Figure 1. The central nervous system of *Chelifer*. H, the nervous system from above, showing some of the nerves, cells and groups of cells which may in part represent ganglia and some of the tracheal tubes in the nervous system. The brain is at the top of the figure. I, central nervous system of Chelifer shown in ventral view. The palpal nerves are those at the top of the figure. Compiled from several nervous systems. X50.

Most of the usual neuroglical methods were used, such as those of Golgi, Cajal and methylene blue, but with small success. The best preparations were obtained by fixing in Flemming's fluid and staining on the slide with methylene blue, neutral red or hematoxylin. For a clear idea of the form of the ganglion and nerves, dissections were made of fresh and preserved specimens. Usually the dorsal body-wall was removed in one piece and the

internal organs separated with needle points. The best results from this method were obtained from formalin fixation, for this reagent left the tissues more transparent and less fused with each other. The tracheæ within the nervous system were demonstrated by mounting the freshly removed nervous system to a glycerine solution. The air in the tubes made them clear and conspicuous structures.

General Form of the Ganglia. The central nervous system consists of a closely fused mass of supra- and sub-esophageal ganglia. From above, the "brain" forms a nearly spherical dorsal mass. Back of this and below the esophagus, but closely connected with the brain is the fused sub-esophageal and thoracic ganglia. This is not easily seen from above, but when removed from the body it is evident. The globular supra-esophageal ganglion or brain has two pairs of nerves closely associated with its cephalic end. The more dorsal of these is the ocular pair which comes to the brain from the simple eyes on the sides of the head. The more ventral is the mandibular, or rostro-mandibular.

The sub-esophageal ganglion has four pairs of nerves for the legs and a larger cephalic pair supplied to the pedipalps. This larger branch divides into two within the appendage and one of these parts soon divides again. This is similar to the branching shown by Newport in the pedipalps of the scorpion. Two small nerves extend from the caudal region of the ganglion towards the abdomen.

Tracheal Supply to the Nervous System. From the cephalic abdominal region two large tracheal tubes run forward a short distance and then break up into bundles of very small branches. Many of these fine tracheoles pass in masses forward to the thoracic and head region and into the central nervous system. Two chief bundles come to the ganglionic mass from caudal regions, the smaller more lateral bundle is more superficial, it divides into two smaller groups of tubules, a lateral and a median. Both of these send tracheoles to the brain and some small strands run beyond up into the upper regions of the head. The more ventral of the two chief bundles of tracheoles also divides

into two and these are distributed to the lateral medial portions of the sub-esophageal mass of the nervous system. The trachea within the nervous system are not as abundant as in insects. Long tracheoles pass through the brain and ganglion as straight or slightly curved lines. There is no branching or anastomosis.

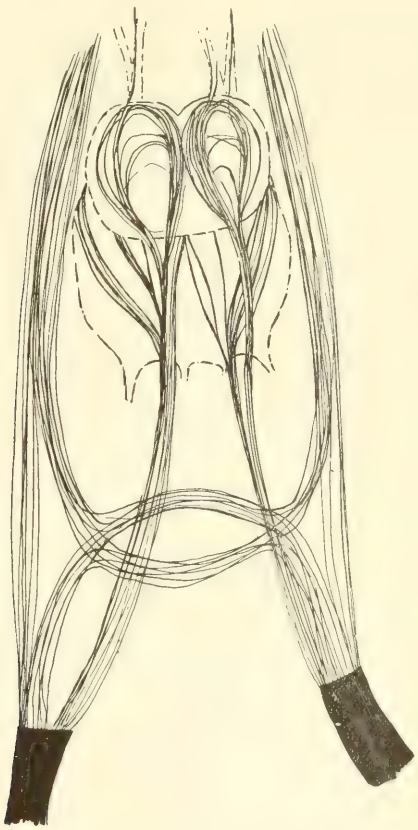

Figure 2. Diagram of the tracheal supply to the central nervous system of *Chelifer scabisculus*. X50.

The paper by Allen '04 on the anatomy of one of the Acarina is the only one I have found referring to the tracheæ in the central nervous system of Arachnida.

Sense Organs and Peripheral Nerves. Scattered or grouped sensory hairs are found over the surfaces of the body, especially

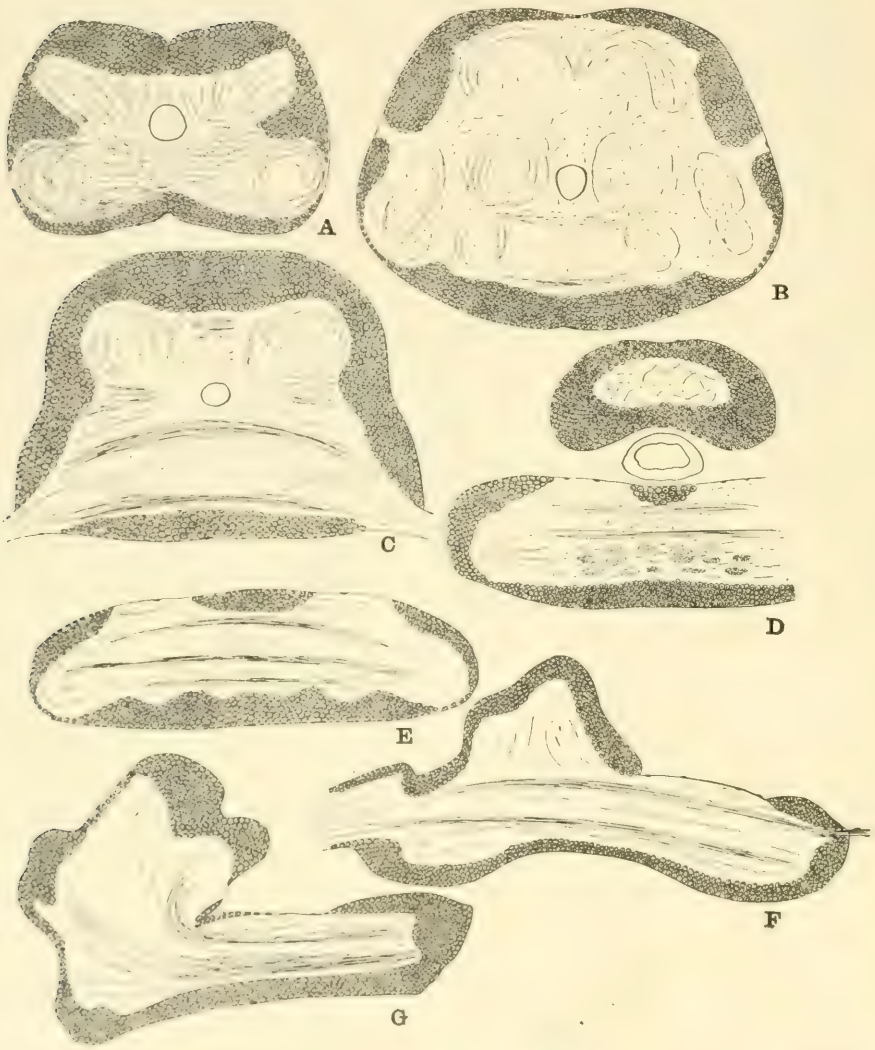

Figure 3. Drawings from sections through the central nervous system of *Chelifer*. All figures X200. A to E, cross sections through the nervous system of a single individual at various levels. The dorsal side is up. A, section through the cephalic end, esophagus in the center, general distribution of fibers and cells shown. B, a similar section farther down. C, section through leg nerves. D, section through the caudal end of the brain. E, section below the brain. F and G, sections cut longitudinally through the nervous system of a young *Chelifer fuscipes*. F, is nearer the middle line and through an abdominal nerve. The dorsal side is up in both and the head end to the left.

on the dorsum. The appendages are also clothed with similar small hollow hairs of the type found so generally among arthropods. These hairs are very small in many places but in certain regions as on the pedipalps they are very long and slender. The hairs are not only hollow but there is a passageway through the chitin below the seta, even in places where the body-wall is very thick. Some hairs are sunken at their bases and the whole neighborhood of the seta elevated into a little knob. Sensory cells of a bipolar type are found at the bases of the hairs in the more perfect sections, these send one process into the base of the hair. These cells were often easily distinguished from the surrounding hypodermal cells by their different shape and staining reactions although the cell process might not extend into the hair. It seems probable that all the hairs of the animal are sensory and probably tactile. Possibly the long hairs of the pedipalps are also tactile. There was no evidence of any other sense organ except the eyes. In addition to the usual type of hair just described a simple branched form was found.

There are two simple eyes, one on either side of the head near the base of the pedipalps. These eyes consist of a thin layer of clear chitin on the outside and a small group of sensory cells below this. On the surface of the cornea of chitin a number of regular knobs of small size take certain stains such as methylene blue.

Peripheral nerves, such as those supplied to muscles were found especially in longitudinal sections of appendages. These strands were found to be very delicate and deeply staining nuclei were found along the course of the fibers.

Peripheral Ganglia and Plexuses. No very definite peripheral centers were found in *Chelifer,* but in certain dissected specimens in the head and thoracic region there are individual cells and small groups which undoubtedly serve as peripheral ganglia. Some of these seem to be quite intimately connected with the more cephalic nerves and the central nervous system. Some of these seem to be true nervous elements although all may not be. Most of the cells and groups of cells are clustered about the cephalic portion of the nervous system. The numerous

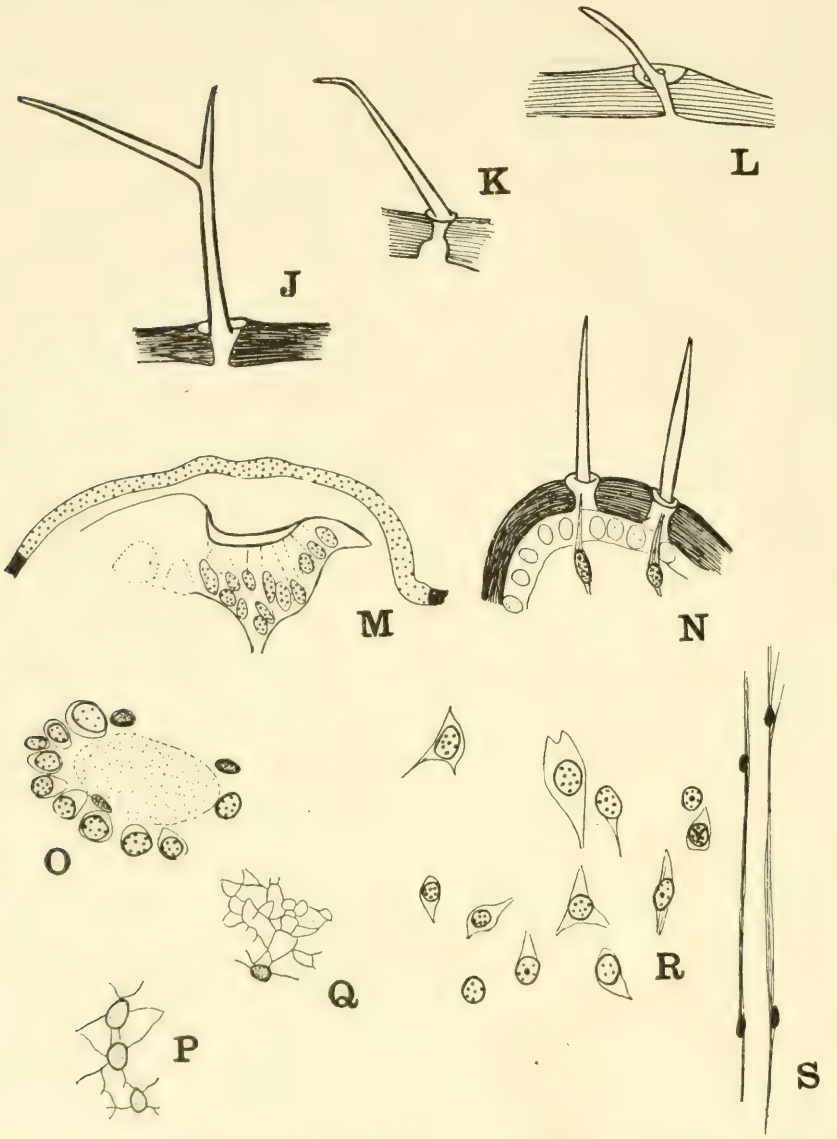

Figure 4. Details of structure of *Chelifer*. All figures X700. J. K. L, types of hairs shown in section. N, hairs supplied with nerve cells and fibers, from *Chelifer fuscipes*. M, Section through an eye, nearly all of the sensory cells are shown in this section, the clear chitin above the sensory cells appears covered with small bodies which stain. These are shown as dots in the drawing. O, section across the rostro-mandibular nerve trunk showing nerve cells at the surface. P, neuroglia cells from the center of a cell area, the nerve cells lie between the strands. Q, neuroglia cell with a part of the network of fibers which forms a support for the nerve fibers in the center of the ganglion. R, nerve cells from the central nervous system. S, nerve strands from the peripheral nervous system.

ganglia of *Phalangium* as described by Loman '05 seem to resemble the peripheral masses of *Chelifer* although they seem to be more caudal in position.

In addition to these cells and irregular masses about the central system there are a number totally or partially surrounding the mandibular nerve some distance from the brain.

There are scattered cells, apparently nerve cells, under the hypodermis and some of these may be similar to the peripheral plexus described in insects. Methylene blue used repeatedly failed to demonstrate such a plexus however.

Nerve Cells of the Central Nervous System. The nerve cells are rather small, closely crowded together with large nuclei and very little cytoplasm. The cells vary little in size and present a uniform appearance in all parts of the central ganglia. Some of the cells have two or more processes, but most cells are unipolar with the process directed out to the central mass of fibers. Cells in small groups may in places send their fibers in together, forming a distinct bundle. No demonstration of special granules of tigroid substance was made although the usual methods for its demonstration were used, but the large nuclei nearly always showed six or eight distinct masses of chromatin. Sometimes there was an indication of a larger body which may have been a nucleolus. In some cells instead of rounded masses of chromatin there were longer rod-like masses.

The neuroglia cells were easily demonstrated. They had rather large nuclei and very little cytoplasm forming a meshwork of strands. In the meshes of this network the nerve cells are arranged, much as Haller '12 has described and figured for spiders. A delicate membrane of thin cells with prominent nuclei surrounds the nervous system as shown in Haller's figures.

Cell Areas. In the brain the nerve cells cover the central fibrous mass on all sides. The cells are most numerous at the cephalic and caudal ends and also laterally. In the mid-dorsal region they are least abundant, forming in places hardly a double row. The more cephalic ventral portions of the supra-esophageal ganglion are indistinguishably fused with the subesopha-

geal. The prominent cephalic and caudal masses of cells seem from the position of the nerve trunks and the arrangement of the fibers to be largely associated with the optic and mandibulo-rostral nerves respectively.

The subesophageal ganglion is rather uniformly covered with rather thick masses of cells ventrally, there is but little indication of more marked masses where the leg nerves are given off. The lateral parts of the ganglion are also covered with nerve cells and these reach up dorsally except where nerve trunks arise. On the dorsal side there are few nerve cell groups towards the middle line except at the cephalic and caudal ends.

Distribution of Fiber Tracts. In the brain there are few large commissures, one large band is sometimes made out ventrally, but there are many cross fibers not definitely located in distinct bundles.

In the subesophageal ganglion there are two main commissures usually evident connecting lateral parts. The more dorsal of these is especially marked in the cephalic regions of the ganglion and in places appears as an arched band just dorsal to the central region. Towards the lower end of the ganglion the more ventral commissure often appears divided.

Fibers from the brain run in long and shorter tracts and connect the brain with lower levels. Some of these fibers run into the long dorsal and ventral tracts which run the length of the ganglion similar to those described and figured by Haller '12. The dorsal tract probably connects wider areas; it seems to have a large part of the fibers of the abdominal nerves. Fibers from and to the brain connect the dorsal tract to posterior regions, and ventral tracts are broadly connected with the anterior region of the brain. Short connectives are found in all parts, cells in each region do not send their fibers straight in to the central part of the ganglion in every case, but may act as connecting cells for neighboring parts. The brain is closely connected to the rest of the central nervous system and short connections are found as well as the longer ones mentioned. In the lower regions there are many connections from one area to the next.

Haller '12, homologizes areas in the spider and scorpion brain to the mushroom bodies of other arthropods. These areas are located in the dorso-lateral portions of the nervous system in cephalic and caudal regions. These areas are marked by clusters of small nerve cells and small clear areas in this region. In *Chelifer* all the cells are about the same size; there are, however, little clear areas in the same general regions of pseudoscorpions. There are two areas on each side of the brain dorsally just in front of the great caudal dorsal mass of cells and just back of the cephalic dorsal mass. These little areas are almost free from cells and they seem to be the only indications of anything like mushroom bodies.

In some specimens the fibers are intensely stained and at certain areas such as the region just under the large cephalic mass of cells on either side of the brain, fibers extend down from the cell areas of the brain. It is possible that some of these fibers represent connections which correspond to the mushroom fibers.

IMPORTANT CONCLUSIONS

1. There are no important abdominal ganglia beyond the fused mass of the central nervous system.
2. The pedipalpal nerves are the largest.
3. A small number of simple more or less straight tracheoles penetrate the nervous system.
4. There are few deep-staining masses of fibers.
5. The cells have very little cytoplasm. The nuclei are usually provided with six or more chromatin granules.
6. The sense organs so far as determined are: a pair of simple eyes and hollow setæ provided with nerves from bipolar nerve cells.
7. The cells of the brain are largely unipolar, but other forms are found.
8. The neuroglia cells form a network of their fibers and this network between nerve cells serves as a sort of sheath for them. The fibrous part of the nervous system also has strands from neuroglia cells and this forms a support for the nerve fibers which run in various parts of the ganglia.

9. There are very slight indications of mushroom bodies.

10. Apparently the two great masses of cells in the brain are associated with the mandibulo-rostral and optic nerves.

11. The peripheral ganglia are represented by irregular masses of cells.

12. Besides numerous short connections there are large tracts running from the brain to other levels, and a dorsal and ventral longitudinal tract in the subesophageal ganglion.

13. There are two to three well marked commissures in the ventral mass of the nervous system.

14. The brain is closely fused with the ventral mass of the ganglion.

15. There are no abdominal ganglia. In general the nervous system is more like that of a spider than of a scorpion.

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(Contribution from the Zoological Laboratory of Pomona College.)

A New Species of Collembola From Laguna Beach

GERTRUDE BACON

In Vol. IV, No. 3, of the Journal of Entomology, I described some Collembola found at Laguna Beach of the genus *Isotoma*. During the same summer, under the same conditions and environment, I found a great number of specimens of the genus *Entomobrya*, which, due to the kindness of Professor L. W. Folsom, were identified as belonging to a new species. These were found on the under side of large rocks as far out in the water as it was possible to turn over the stones. This is the first time that this genus has been reported found under rocks in salt water. This species occurred very abundantly, far more so than any of the others, and was collected in great numbers. This paper is a study of the characteristics of this species.

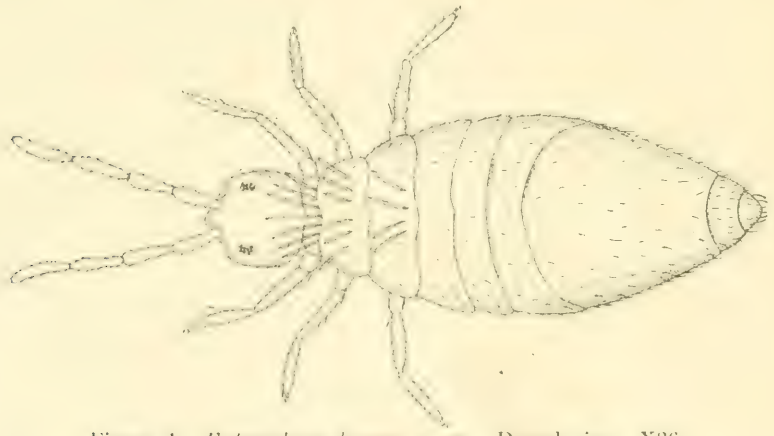


Figure 1. *Entomobrya laguna* n. sp. Dorsal view. X36.

Entomobrya laguna n. sp.

(Figs. 1, 2 and 3)

Length 2 mm. *Color*—Dark brown mottlings with yellow ground color except on the ventral side of body, furcula, thorax

I, and the beginning of each segment, which are yellow; antennæ and legs dark blue. There is not a great range in the color variation, although in some specimens the yellow predominates, in others the brown mottlings. Body sub-cylindrical, widest at segment VI; covered with fine hairs with many large geniculate ones on the anterior part of the body and short clubbed ones on the last segment of the abdomen. For the sake of clearness only a few hairs are shown in Figures 1 and 2. Head held horizontal, sub-cylindrical in shape. Antennæ (Fig. 3, A) about three times as long as head; four segments subequal in length; IV longest; I shortest; II and III subequal. Ocelli (Fig. 3, B) sixteen, eight in each eye spot, six large and two

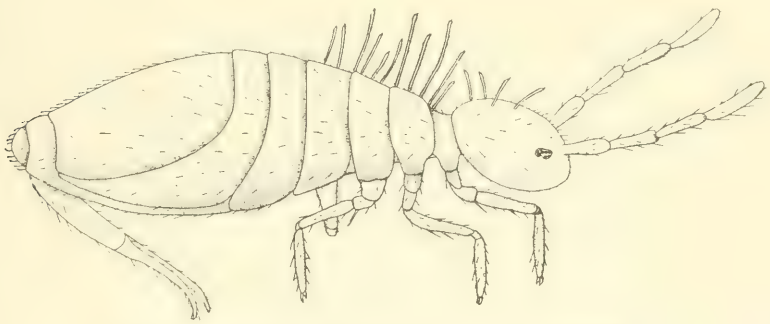


Figure 2. *Entomobrya laguna* n. sp. Side view. X36.

smaller ones. There was a great deal of variation found in the size and arrangement of the ocelli, in some the smaller eye spots were very minute while in others they were nearly the same size as the other six. Thorax—I visible, II largest. Legs long, slender; long femur and tibia, small tarsus with two claws (Fig. 3, C, D, E). Both are wide at the base and then become narrow and pointed; superior armed with two teeth opposite each other and at the end of the dilated portion; inferior armed on the outer side about midway with a very minute tooth not visible on some of the claws. The claws on the three pairs of legs differ somewhat. On the first the claws are about equal in length and both about equal in width at the base; the inferior slopes abruptly into a point. On the second pair of legs the superior is the

longest, the base of the inferior is not rounded but changes to the slender part abruptly, making an angle. In the last pair of legs the claws are farther apart, equal in length; the inferior is more curved than on any of the others. Abdomen—The seg-

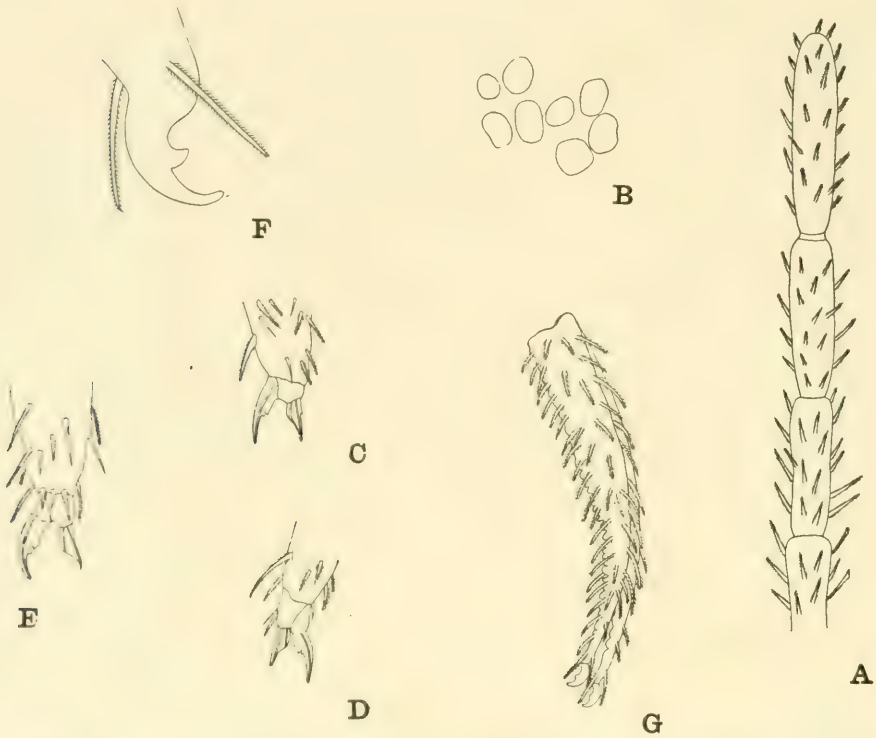


Figure 3. *Entomobrya laguna* n. sp. A, antenna; B, eyes of one side; C, claws; D, claws of scond pair of legs; E, claws of third pair of legs; F, mucrones; G, dentes with mucrones. A, X90; B, X252; C, D, E, X216; F, X432.

ments are unequal, IV more than four times III; ventral tube well developed. Furcula—(Fig. 3, G) Dentes and mucrones a little longer than manubrium; dentes serrated and densely covered with plumed hairs. Mucrones—(Fig. 3, F) Two teeth, no basal spine.

(Contribution from the Zoological Laboratory of Pomona College.)

Shorter Articles and Reviews of Recent Important Literature

SEVENTH KERMES (*COCCIDÆ*) FROM CALIFORNIA

GEO. B. KING
Lawrence, Mass.

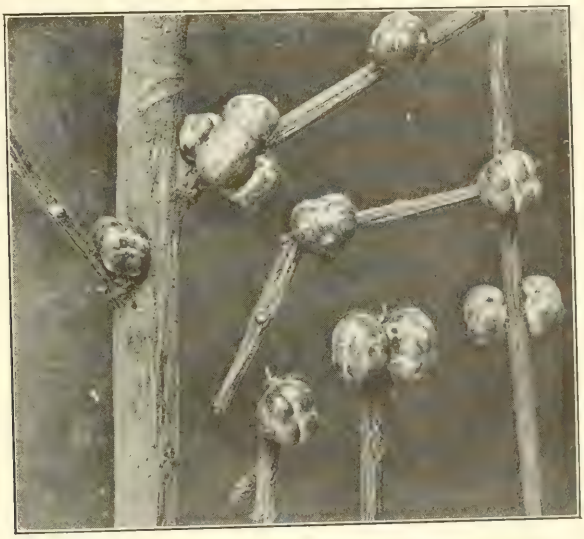


Figure 1. *Kermes essigii* King on twigs of the California Coast live oak, *Quescus agrifolia* Neé. Twice natural size. (Photo by E. O. Essig).

Kermes essigii n. sp.

Female scale—Light brown, 6 mm. long, 6 mm. broad and 5 mm. high; surface shiny. Under normal conditions practically globular, of two distinct forms, one with a deep broad longitudinal constriction, with sides bulging, and four transverse bands of a light cream color. The constriction is not pallid, but of the same color as that of the scale, light brown. The entire surface is peppered with minute black specks, only visible through a hand lens of 20 diam.; there are also several large black dots about the size of a pin head viewed under a hand lens. The other form is of the same

color and markings, but distinctly gibbose. Treated with KOH the scale turns black, and after prolonged boiling it turns liquid black. Derm after boiling, by transmitted light, yellowish, no structural characters visible.

Larvæ—Dark red-brown (lost in boiling in KOH), elongate-oval.

This is a very pretty species. Its nearest ally is *K. galliformis,* from which it is separable by having a longitudinal constriction which is not pallid, and by being gibbose. It is also allied to *K. cockerelli* and *K. gillettei* in being gibbose. It was first collected by Mr. E. O. Essig in the Santa Paula Canyon in the mountains near Santa Paula, Ventura County, California, in 1910. In August, 1913, Mr. S. A. Pease collected it in San Bernardino County. Through Mr. Essig and Prof. Cockerell this material was turned over to me. The species was described from the large number of females in these sendings.

The host plant is the California coast live oak, *Quercus agrifolia.*

I am pleased to name it after its first collector.

THE EIGHTH CALIFORNIA KERMES

Kermes occidentalis n. sp.

GEO. B. KING
Lawrence, Mass.

Female Scale—Globular in outline; 5 mm. in diameter; of a dull gray color. Segmentation indicated by five transverse narrow blackish bands, which are broken at intervals by somewhat larger round black dots. Surface between the bands of a marbled light gray-brown. The entire surface is dull, not shiny, and is covered with very minute black specks seen only under a hand lens.

The above species was received from Mr. E. M. Ehrhorn in 1901 taken on *Quercus* sp. in California and labeled *Kermes galliformis* Riley. The latter species is very different, the color being pale yellow; appears minutely and evenly speckled with brown under a hand lens and is more or less confused or mottled with gray or brown.

Just recently Mr. E. O. Essig sent me *Kermes galliformis* Riley and *Kermes cockerelli* Ehrh. collected by Mr. E. J. Branigan on Cache Creek near Yolo, Yolo County, California, May 16, 1910, on California black oak, *Quercus kelloggii* Newb. Here they were associated together on the same host plant. *Kermes cockerelli* Ehrh. is of a light brown color and strongly gibbose.

In some of the markings *Kermes occidentalis* is nearest allied to *Kermes arizonensis* King, found in Arizona.

Figure 1. a, *Kermes occidentalis* n. sp.; b, *Kermes cockerelli* Ehrh.; c, *Kermes galliformis* Riley. (Photo by E. O. Essig).

A COCCID FOUND ON THE SYCAMORE

H. J. RYAN

A number of the genus *Pseudococcus* were found under the bark of a sycamore within the limits of Claremont, California. Only one tree was found to have these insects on it although there were several in the cluster. The insects were associated with ants which seemed to be guarding them. In general appearance the species appears like *P. citri,* differing, however, in having less prominent lateral appendages, callouses on the lateral margins of the segment bearing two short spines, and with circumanal spines of the same length as those of the anal lobes. As nearly as has been determined by comparison with the descriptions given for *P. quercus,* the specimens

resemble this species. The host plant of *P. quercus* is given as the canyon live oak, *Quercus chrysolepis,* and if these are of this species then it is worthy of note that *Platanus racemosa* as well as *Quercus chrysolepis,* is a host.

MOSQUITOS AND COBWEBS

James Zetek, Ancon, C. Z.

During February and March, 1913, extensive breeding in a salt-water marsh along the old French canal caused a heavy influx of adults of *Anopheles tarsimaculata* Goeldi and *Aedes taemiorhynchus* Wiede., at Gatun, Canal Zone, about 4,000 feet distant. A cement shed and a store house, only 600 feet to the south-west from the breeding place contained many cobwebs, and these were so weighted down with mosquitos of the species mentioned, that in several cases the webs showed breaks. It is no exaggeration to say the cobwebs were black with these mosquitos.

Another instance of mosquitos in cobwebs was seen June, 1913, in native shacks near Culebra, C. Z. In these there were on an average of six mosquitos to a web, principally *Culex quinquefasciatus* Say and *Aedes calopus* Meigen. Two specimens of *Mansonia titillans* Walker, three of *Aedeomyia squamipennis* Arib. and three of *Lutzia bigotii* Bellardi were also noted in these webs.

The last instance was noted in October, 1913, at Paraiso, C. Z., while with Doctor Martini and Mr. Pickett. In a single shack, adults of *Culex quinquefasciatus* Say were present in cobwebs. It did not appear that the spiders cared much for such food, probably because larger diptera were plentiful and to be had easily. It seems mosquitos are accidentally entrapped in these webs while seeking shelter in corners of buildings.

PRELIMINARY REPORT ON THE PARASITES OF COCCUS *HESPERIDUM*

P. H. Timberlake

Jour. Economic Entomology, Vol.VI, No 3, 1913

In this paper a short sketch of *Coccus hesperidum* itself is given and then a very careful description of the five parasites and eight hyperparasites of the scale. The author closes with a paragraph on the source of the soft scale in California and a paragraph on the predaceous enemies of the scale.

GEORGE ASH.

The first of a series of pamphlets on the "Control of the Orange Maggot (*Trypeta ludens*)" has been published by D. L. Crawford for the Mexico Gulf Coast Citrus Association. Mr. Crawford studied this pest while he was in Mexico in the summer of 1910. Because of his knowledge of the subject, this association called him to Mexico last summer to lay out directions for fighting the Orange Maggot.

The circular states that the Orange Maggot is distributed over a large portion of Mexico. It attacks several fruits other than citrus fruits and this makes it more difficult to control. In order that the members of the association may work intelligently on the fly, a brief life history is given. Mr. Crawford gives two sets of directions for the control work. One method is to pick up the fruit as fast as it falls and to destroy it while the maggot is still working inside. The other method is to spray the trees with a poisoned, sweetened liquid in the period when the flies appear. The flies eat this poisoned bait and are killed.

E. T. MCFADDEN.

Laguna Marine Laboratory and Tank House.

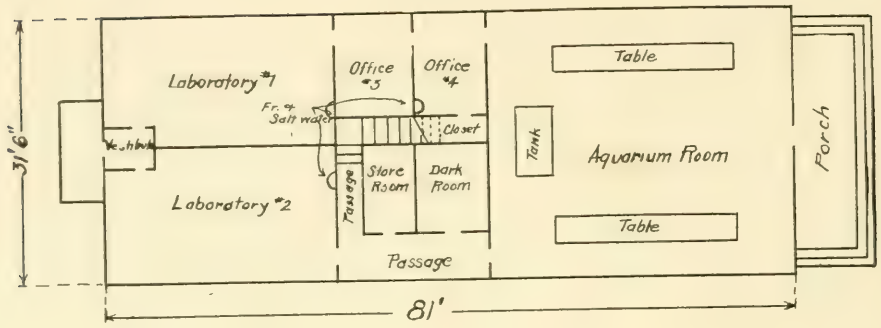
The Laguna Marine Laboratory

One of the most interesting and beautiful parts of the Southern California coast is found at Laguna Beach. The rugged cliffs, the level stretches of shore, the high hills and above all the great abundance and variety of plant and animal life make it

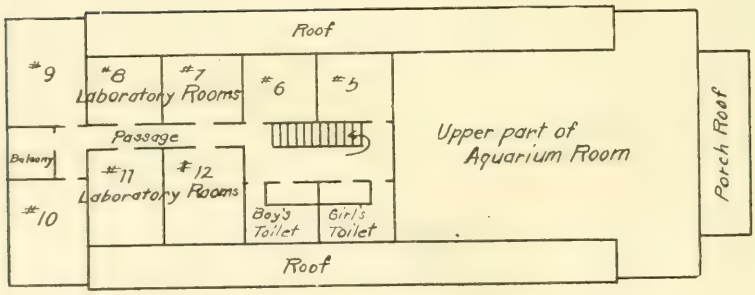
The channels just north of Laguna. These channels are very deep and contain a magnificent display of kelps (*Eisenia* and *Egregia*). This whole area is exceedingly rich in life. From first Laguna report.

an ideal situation for a Biological laboratory. The summers are cool and the winters are warm so that work may be done here at any time of the year. Pomona College has conducted summer school work at Laguna for the past three years and two buildings were erected for this purpose in the spring of 1913. The chief

First Floor



LAGUNA BEACH MARINE LABORATORY



Second Floor

structure has a large aquarium room in front and two class laboratories back of this, all provided with running water. In addition to this on the first floor there are store rooms, a dark room and private laboratories. Up stairs there are eight more private rooms for special investigators. A tank house near the larger building furnishes salt water for the aquaria and salt

Cypselurus californicus. From Metz, first Laguna report.

water taps. There is considerable additional room in this building.

The laboratory will be used largely for teaching in the summer but there will be opportunity for special investigators to work at any time of year and for any period. It is the hope that this station may be useful to any qualified botanist or zoologist who

Showing one of numerous small bays with sand beaches. At low tide, between the rocks in foreground and the point at left, a large bed of Phyllospadix is accessible. From first Laguna report.

Showing region just north of pier at low tide. A large area of rich tide pools are very accessible here. From first Laguna report.

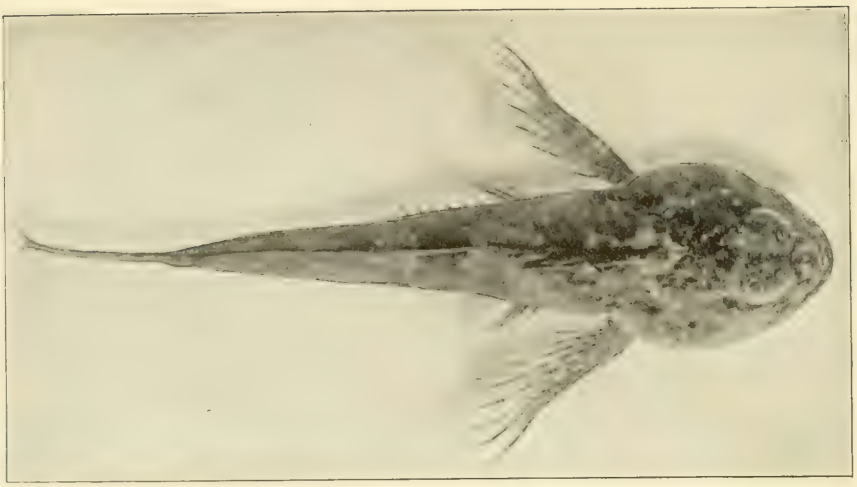
may wish to study for a time in this part of the country. The summer course aside from the work of special investigations will be given as a part of the work of Pomona College summer school, although of course it will be open to any others who may be prepared.

The laboratory buildings are situated at the foot of the cliffs a short distance back from the ocean and a convenient distance from one of the best collecting grounds. Great masses of sea

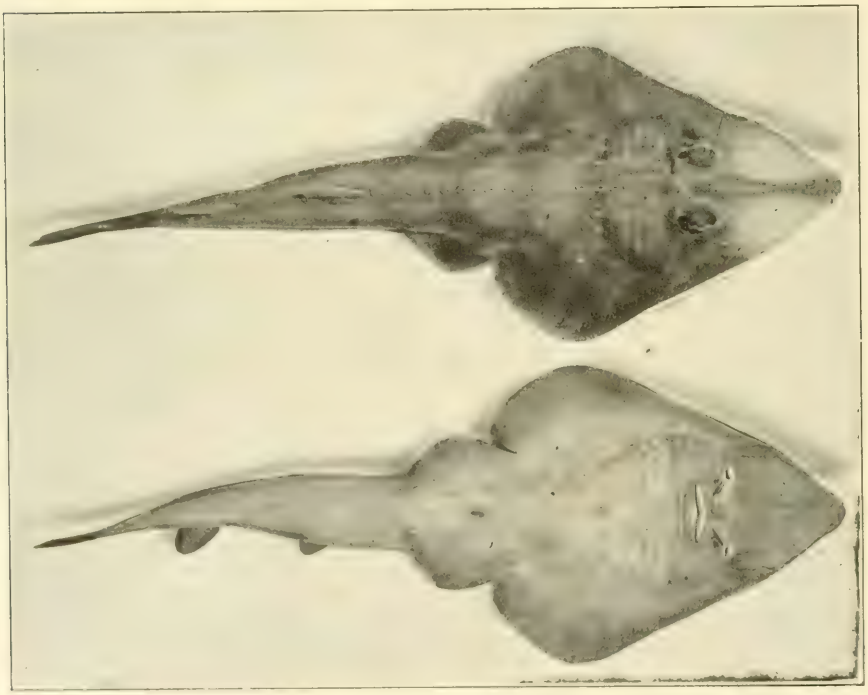
Showing the tide pools at Mussel Point. Here are immense colonies of mussels, barnacles, sea urchins and coralline algæ. This place is exceedingly rich collecting ground. From the first Laguna report.

weed grow on the nearby rocks, while out a short distance great kelp beds furnish hiding places for many forms of animal life. The irregular rocks and points, the inshore pools and channels at low tide are alive with a great variety of plant and animal forms.

Some of the many interesting types which have been found along the shore might be mentioned to give a little idea of the

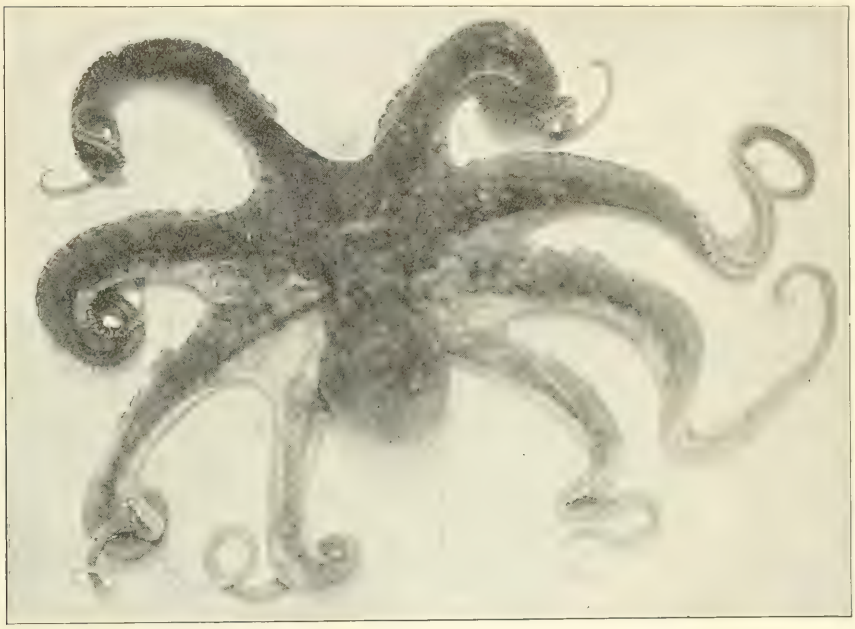


Clinocottus analis. From first Laguna report, after Metz.



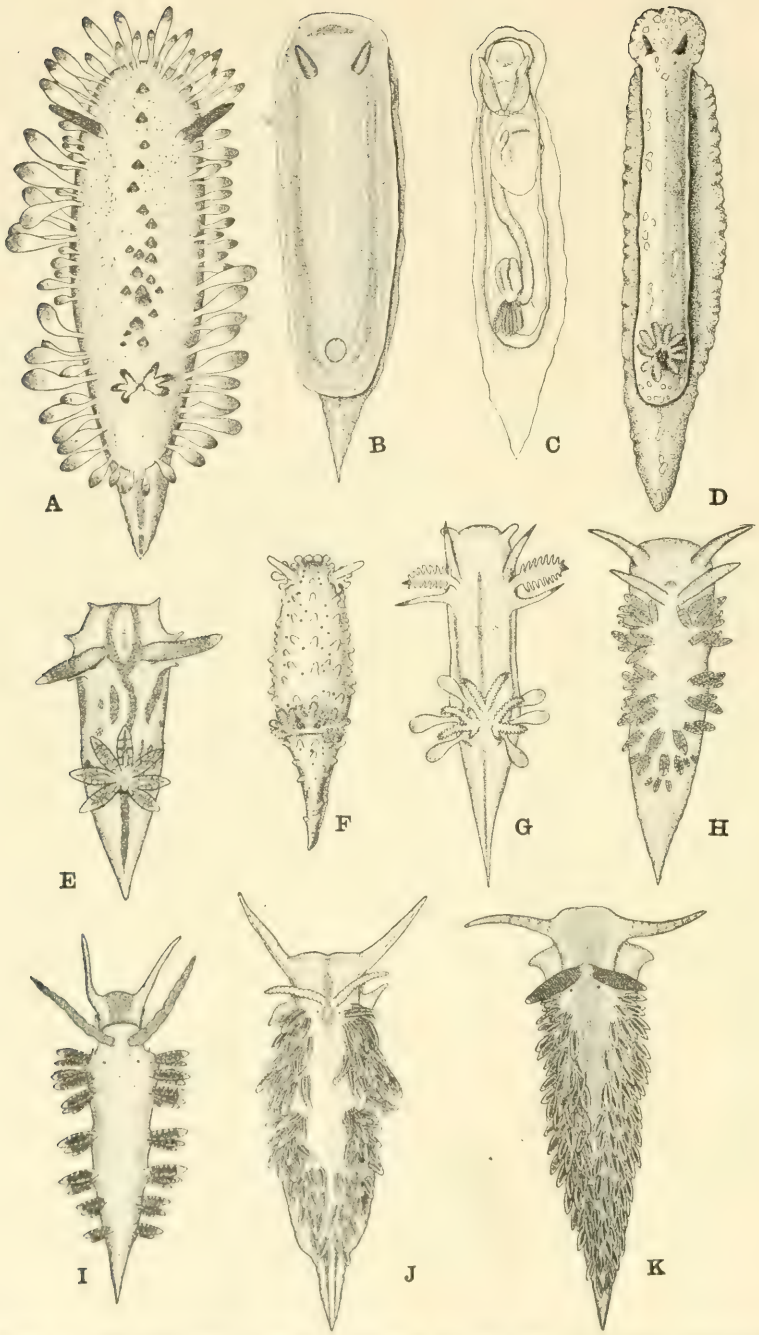
Young *Rhinobatus productus.* From Metz, first Laguna report.

variety and abundance of life. There are the sea weeds, brown, green and red, of many kinds and in great abundance over the rocks near shore as well as farther out. Nearly a hundred species of these have been identified so far. Sponges both simple and complex are found in the kelp. Sea anemones are abundant over rocks and in the tide pools near shore. In the sand and under rocks are many kinds of segmented worms, while flat worms and round worms are also abundant in various places.



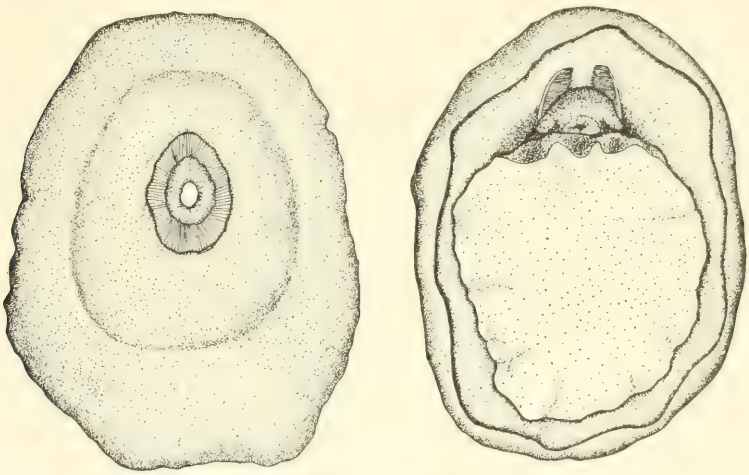
Polypus bimaculatus. From Berry, first Laguna report.

There are three kinds of starfish, three species of sea urchins, several sorts of brittle stars and two species of holothurians, all of which may be obtained at low tide. Of the snail-like animals a large number have been found, many of the smaller ones have very beautiful markings and shades of color; there seems to be a variation in the occurrence of these from year to year. Among the larger molluscs are the key-hole limpet, abalone and the sea hare. Over fifty species of shells were collected one summer



Some of the nudibranch molluscs found at Laguna. A, *Laila cockerelli;* B, *Chromodoris porterae;* C, *Chromodoris* sp. (mantel removed); D, *Chromodoris* sp.; E, Genus?; F, *Aegires albopunctatus;* G, *Aucula pacifica;* H, *Cuthonia* sp.; I, *Hervia* sp.; J, *Hermissenda opalescens;* K, *spurilla* sp. From Guernsey, first Laguna report.

within a limited range. The octopus *Polypus bimaculatus* is abundant along the rocky shore and may be obtained at low tide. The sand, the rocks and the sea weeds are alive in many places with crustacea of many sorts, crabs and sand fleas of many species are abundant. There are several species of barnacles, and many very small crustaceans may be seen in the tide pools. Fish are abundant at Laguna and near by. Several species of sharks are found off shore, the shovel nose *Rhinobatus productus* among them. The moray *Gymnothorax mordax* is found

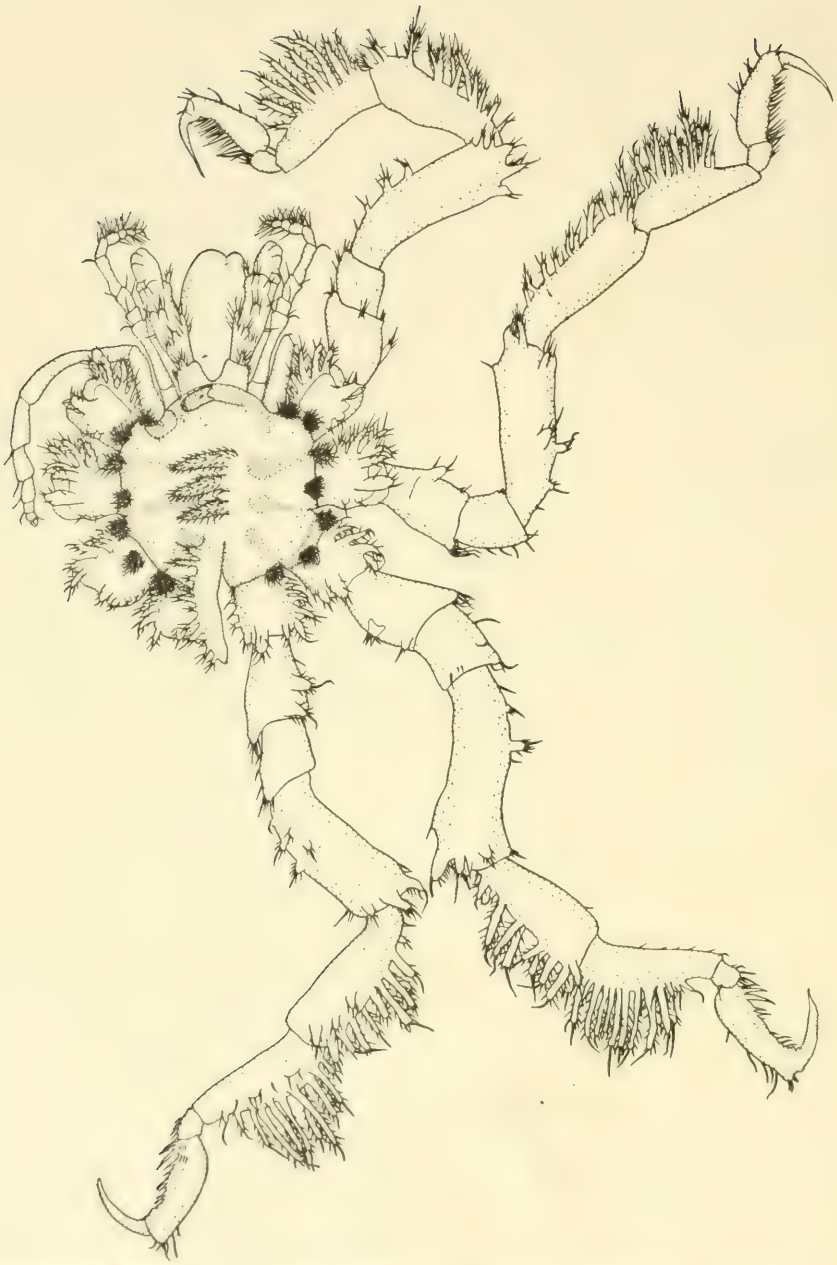


Lucapina crenulata. Dorsal and ventral views. From Guernsey, first Laguna report.

under rocks near shore at low tide. The flying fish *Cypselurus californicus* occurs off the coast and many other fish are abundant out a short distance about the kelp beds. A great variety and abundance of forms may be seen in the numerous tide pools, including one very interesting blind species.

In addition to the wealth of the sea, the hills and canyons furnish collecting places for many land forms and it is expected that the land and fresh water species will also be studied.

Laguna may be reached by auto stage from Irvine or Santa Ana. Stages run twice a day each way in the summer and once in the winter.



Ammothella spinosissima, much enlarged. A Laguna pycnogonid. Hall, first Laguna report.

Students may be admitted to courses in the summer school at Laguna who have entered college or who have finished their high school course. For those who register for regular courses the work will begin the last of June and continue six weeks. The following zoological courses will be offered; others may be announced later:

1. General Biology, with special reference to marine conditions. Lectures, recitations, field and laboratory work. For those who have had no biological work.

2. General Zoology. Lectures, laboratory and field work. A study of all the great groups of animals, their structures and relationships. Open to those who have had a course in biology.

3. General Entomology. Lectures, recitations, laboratory and field work. A study of the important orders and families of insects. Open to any who have had a course in general biology or zoology.

In addition to these courses general histology and microscopic technique and general embryology may be given to a limited number.

For further information address: Department of Zoology, Pomona College, Claremont, California, U. S. A.

News Notes

FORDYCE GRINNELL, JR.

"But, of still greater moment, is a letter in which Wallace tells Bates that he begins 'to feel dissatisfied with a mere local collection. I should like to take some one family to study thoroughly, principally with a view to the theory of the origin of species.' The two friends had often discussed schemes for going abroad to explore some virgin region, nor could their scanty means prevent the fulfilment of a scheme which has enriched both science and the literature of travel. The choice of country to explore was settled by Wallace's perusal of a little book entitled *A Voyage up the River Amazons, including a residence in Para*, by W. H. Edwards, an American tourist, published in Murray's 'Family Library,' in 1847. In the autumn of that year Wallace proposed a joint expedition to the river Amazons for the purpose of exploring the natural history of its banks."

—*Clodd, Pioneers of Evolution.*

"That which is in the man is greater than all that he can do."

—*Jordan.*

Alfred Russel Wallace, the eminent naturalist, died in London, England, Nov. 7, aged 91 years. He visited California in 1887, on a lecturing and sightseeing tour.

Dr. Edwin C. Van Dyke, president of the Pacific Coast Entomological Society, has become a member of the Department of Entomology of the University of California.

Mr. H. H. Newcomb talked before the boys of the Lorquin Natural History Club in Los Angeles, on November 7, on some of his collecting trips in the eastern states.

The Rivers' Natural History Club, for boys, has been organized in Los Angeles, named after the oldest living naturalist of California, J. J. Rivers, who is 88 years of age.

Mr. E. J. Newcomer, well known as a collector and student of Lepidoptera, has been contributing a series of articles to the

California Cultivator on his observations of agricultural conditions in southern Europe.

Prof. Ralph Benton, of the University of Southern California, addressed the Biological Section of the Southern California Academy of Sciences, in October, on Bees; and on November 11 the Section was addressed by Dr. S. S. Berry on his work with the Cephalopods, and Mr. Harry S. Swarth spoke on "The Birds of Southern California."

Wants and Exchanges

Subscribers and others are urged to use these columns to make their wants known. As the Journal goes to all parts of the world we hope to make this a very useful feature of the publication. Exchange notes are free to subscribers.

WANTED—Myriopods from all parts of the world. Will name, exchange or purchase. R. V. Chamberlin, Mu. Comp. Zoology, Harvard Univ., Cambridge, Mass.

Will exchange insects of any order from Southern California, for Microlepidoptera from any part of North America, preferably pinned, with complete data concerning capture. Fordyce Grinnell, Jr., Pasadena, Cal.

HEMIPTERA—California Homoptera and Heteroptera, including all families, exchanged for specimens from all parts of the globe, but especially from North America.—E. O. Essig, Secretary State Commission of Horticulture, Sacramento, Cal.

WANTED—Cephalopods (in alcohol); Chitons (in alcohol or dry); shells of West American Mollusca; zoological literature. Offered: West American and other molluscan shells; zoological pamphlets, mainly on the Mollusca. S. S. Berry, 502 Cajon St., Redlands, California.

California Syrphidæ, Aphididæ to exchange for non-California Syrphidæ. W. M. Davidson, Walnut Creek, Cal.

WANTED—For exchange, papers on marine and fresh-water Protozoa. Albert L. Barrows, Department of Zoology, University of California, Berkeley, Cal.

WANTED—Information on any mite-papers for sale or exchange that have an economic bearing. H. V. M. Hall, Room 8, Court House, San Diego, Cal.

WANTED—Specimens and separates relating to the pseudoscorpions, in exchange for local species. M. Moles, Claremont, Cal.

WANTED—Literature and determined specimens of Collembola, in exchange for local forms and literature. G. Bacon, Claremont, Cal.

WANTED—Determined specimens of Thysanura in exchange for local species. R. Gardner, Claremont, Cal.

WANTED—Separates relating to the nervous system and sense organs of the invertebrates in exchange for reprints by a number of authors on this and other topics relating to the anatomy of invertebrate animals. W. A. Hilton, Claremont, Cal.

THE BUTTERFLY FARMER

A monthly magazine for amateur entomologists. A comprehensive correspondence course in entomology, conducted under the auspices of The Agassiz Association, will be a leading feature during the present year. Subscription $5.00 per annum, single copies 50 cents. Names of dealers and purchasers and wants of subscribers advertised without charge.

Ximena McGlashan, publisher and proprietor, Truckee, Cal.

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